Indian Institute of Information Technology, Sri City Chittoor

(An Institute of National Importance under an Act of Parliament)

Multimedia Systems
End-Sem Exam – UG3

Total: 60 Marks

Date: 19/04/2022
Duration: 3hrs.

S20190010007

Answer all questions.

1. (a) Explain the steps followed in JPEG compression in detail. [5+2+3]

   (b) Explain what the advantages are in taking a block-based DCT instead of the whole-image DCT in JPEG.

   (c) In a typical quantization table for JPEG, the quantization steps increase as we move to the right and to the bottom of the table. Why?

2. (a) Differentiate between Differential Pulse Code Modulation and Delta Modulation. [4+4+2]

   (b) Suppose we use a predictor as follows:

$$\hat{f}_n = \text{trunc}\left(\frac{1}{2}(\tilde{f}_{n-1} + \tilde{f}_{n-2})\right),$$

$$e_n = f_n - \hat{f}_n.$$

   Also, suppose we adopt the quantizer as

$$\tilde{e}_n = Q[e_n] = 16 * \text{trunc}\,[(255 + e_n)/16] - 256 + 8$$

$$\tilde{f}_n = \hat{f}_n + \tilde{e}_n$$

   If the input signal has values as follows:

   20 38 56 74 92 110 128 146 164 182 200 218 236 254

   then what will be the output from a DPCM coder (without entropy coding).

   (c) Write about four popular audio file formats.

3. (a) What is the entropy η of the image below, where numbers (0, 20, 50, 99) denote the graylevel intensities? [2+5+3]

99	99	99	99	99	99	99	99
20	20	20	20	20	20	20	20
0	0	0	0	0	0	0	0
0	0	50	50	50	50	0	0
0	0	50	50	50	50	0	0
0	0	50	50	50	50	0	0
0	0	50	50	50	50	0	0
0	0	0	0	0	0	0	0

   (b) Show step-by-step how to construct the Huffman tree to encode the above four intensity values in this image. Show the resulting code for each intensity value.

(c) What is the average number of bits needed for each pixel, using your Huffman code? How does it compare to η?

[3+3+4]

4. (a) Suppose the alphabet is [A, B,C], and the known probability distribution is P_A = 0.5, P_B = 0.4, P_C = 0.1. How many bits are needed to encode the message BBB by Arithmetic coding?

(b) Consider the dictionary-based LZW compression algorithm. Suppose the alphabet is the set of symbols{0,1}. Show the dictionary (symbol sets plus associated codes) and output for LZW compression of the input 0110011.

(c) Write what you understand by Content Based Image Retrieval (CBIR)?

[5+2+3]

5. (a) Differentiate between MPEG-1 and MPEG-2 video encoding schemes.

(b) Define the terms (i) Macro-block (ii) I-frame (iii) P-frame (iv) B-frame

(c) If the display order of frames arriving at the encoder is given by

I1 B2 B3 P4 B5 B6 P7 B8 B9 I10 B11 P13 B14 B15 P16

What will be the coding and transmission order in case of MPEG-1.

[2+5+3]

6. (a) What are the parameters on which QoS of multimedia transmission depends on?

(b) Illustrate the network protocol structure for internet telephony (VoIP). Explain in detail about the different media-related protocols used here.

(c) What is Video On Demand (VOD). What are the different types of VOD models available today.

End